economy is obligatory in girls' schools if any specific subject is taken at all; so that the chance of any of the others being introduced is very much diminished. It must also be remembered that these subjects are only allowed to be taught to children in the Fourth Standard and upwards; while only about one-fifth of the children in the boys' and girls' schools are to be found at present in these standards. According to the Report of the Committee of Council for Education recently issued, there were 476,761 children presented for examination in these standards, of whom the following numbers only were examined in the science subjects:—

Mechanics	2,109
Animal physiology	24,725
Physical geography	34,288
Botany	1,853
Domestic economy	50,797

Out of 489 boys' and girls' departments under the London School Board, the specific science subjects were taken up, as follows, during the year 1880:—

Mechanics in	4 departments
Animal physiology in	123 ,,
Physical geography in	112 ,,
Botany in	9 ,,
Domestic economy	172 ,,

Mr. Hance of the Liverpool School Board has favoured us with an account of the systematic scientific instruction which is given in the Board schools of that town by a special science staff. The subject selected for the boys is mechanics as defined in the New Code, with a considerable development in the direction of elementary physics. It has been in operation since 1877, and the results for the year 1880–81 are given in the following table:—

Year 1880–81.	Number presented.	Number passed.	Percentage of passes.
Stage I.	797	442	55·46
,, II.	398	261	65·59
,, III.	122	82	67·21
Total	1317	785	59·6

Domestic economy is also taught to the girls in a similar manner. In Birmingham 1200 scholars are receiving scientific instruction in the schools of the Board, and it is stated that the teachers uniformly find that "it added interest to the work of the school, that the children were eager to be present, and that the lessons were enjoyed, and were in fact giving new life to the schools." The Board have found the results so satisfactory that they are now furnishing their newest school with a laboratory and lecture room.

IV. As to science-teaching which does not fall under the provisions of the New Code it is not probable that any large amount is attempted. In Manchester, however, the Board gives instruction to 404 children, all of whom have passed Standard VI., the highest ordinary standard, in the following subjects: physiology; acoustics, light, and heat; magnetism and electricity; chemistry; practical chemistry; botany. This teaching is illustrated by means of good apparatus, &c., and has had a very beneficial effect upon the science and art classes of the town. When it is considered that the provisions of the Code naturally form, in almost all cases, the extreme limit of what will be attempted in the schools, it is important that they should be placed as high as possible. This will be a great advantage to the stronger schools, and no disadvantage to the weaker ones, as the higher branches of science-teaching will of course be optional. Your committee have, therefore, arrived at the following conclusions:—

I. *As to object lessons.* That it is very desirable that Her Majesty's Inspectors should take object lessons into account in estimating the teaching given in an infant school; and that they should examine the classes in the graded schools wherever object lessons are given.

II. *As to class subjects.* That the teaching of such subjects as natural history, physical geography, natural philosophy, &c., should not necessarily be "through reading lessons," as oral lessons, "illustrated by maps, diagrams, specimens, &c.," are undoubtedly better when given by a teacher duly qualified to handle these subjects. They are of opinion, also, that it will be desirable to allow a larger number of class subjects to be taken up in any particular school, and to give in such case a proportionately increased grant.

III. *As to specific science subjects.* That a knowledge of the facts of nature is an essential part of the education of every child, and that it should be given continuously during the whole of school life from the baby class to the highest standard. Of course in early years this teaching will be very rudimentary; but by developing the child's powers of perception and comparison it will prepare it for a gradual extension of such knowledge. They consider also that the early teaching must be very general, while the later may be more specific; they think, however, that the science subjects as given in Schedule IV. are fairly open to objection, as being somewhat too ambitious in their nomenclature and in their scope, and that they ought not to be attempted unless the child has had a previous training in natural knowledge before entering the fourth standard. Thus the specific scientific subjects ought not to be distinct, as they practically are at present, from the previous teaching; greater latitude of choice might be allowed in them; and while they should not afford technical instruction they should prepare the way for any technical classes or schools into which the children may subsequently enter. In regard to domestic economy they are of opinion that most of the points embraced in the schedule would be useful to boys as well as to girls.

IV. *As to examinations.* That in the appointment of Her Majesty's Inspectors some knowledge of natural science should be considered as absolutely requisite; that in examining the children they should direct their inquiries so as to elicit not so much their knowledge of special facts as their intelligent acquaintance with the world of nature around them; and that this may be much better done by oral examination than by paper work.

SECTION A—MATHEMATICAL AND PHYSICAL

On the Economy of Metal in Conductors of Electricity, by Sir W. Thomson.—The most economical size of the copper conductor for the electric transmission of energy, whether for the electric light or for the performance of mechanical work, would be found by comparing the annual interest of the money value of the copper with the money value of the energy lost in it annually in the heat generated in it by the electric current. The money value of a stated amount of energy had not yet begun to appear in the City price lists. If 10*d.* were taken as the par value of a horse-power night and day for a year, and allowing for the actual value being greater or less (it might be very much greater or very much less) according to circumstances, it was easy to estimate the right quantity of metal to be put into the conductor to convey a current of any stated strength, such as the ordinary strength of current for the powerful arc light, or the ten-fold strength current (of 240 webers) which he (Sir William Thomson) had referred to in his address as practically suitable for delivering 21,000 horse-power of Niagara at 300 miles from the fall. He remarked that (contrary to a very prevalent impression and belief) the gauge to be chosen for the conductor does not depend on the length of it through which the energy is to be transmitted. It depends solely on the strength of the current to be used, supposing the cost of the metal and of a unit of energy to be determined. Let A be the sectional area of the conductor; s the specific resistance (according to bulk) of the metal; and c the strength of the current to be used. The energy converted into heat and so lost, per second per centimetre, is sc^2/A ergs. Let p be the proportion of the whole time during which, in the course of a year, this current is kept flowing. There being $31\frac{1}{2}$ million seconds in a year, the loss of energy per annum is

$$31\cdot5 \times 10^6 psc^2/A \text{ ergs} \quad . \quad . \quad . \quad (1)$$

The cost of this, if E be the cost of an erg, is

$$31\cdot5 \times 10^6 psc^2 E/A \quad . \quad . \quad . \quad (2)$$

Let V be the money value of the metal per cubic centimetre. The cost of possessing it, per centimetre of length of the wire, at 5 per cent. per annum, is

$$VA/20 \quad . \quad . \quad . \quad . \quad (3)$$

Hence the whole annual cost, by interest on the value of the metal, and by loss of energy in it, is

$$\frac{1}{20} VA + \frac{31\cdot5 \times 10^6 psc^2 E}{A} \quad . \quad . \quad . \quad (4)$$

The amount of A to make this a minimum (which is also that which makes the two constituents of the loss equal) is as follows:—

$$A = \sqrt{\left(31\cdot5 \,.\, 10^6 psc^2 E \Big/ \frac{V}{20}\right)}$$
$$= c\sqrt{(63 \,.\, 10^7 psE/V)} \quad . \quad . \quad (5)$$

Taking 70*l.* per ton as the price of copper of high conductivity (known as "conductivity copper" in the metal market), we have ·00007*l.* as the price of a gramme. Multiplying this by 8·9 (the specific gravity of copper), we find, as the price of a cubic centimetre,

$$V = \cdot 00062 l. \quad . \quad . \quad . \quad (6)$$

and the assumption of 10*l.* as the par value of one horse-power day and night for 365 days gives, as the price of an erg,

$$10l./(31\tfrac{1}{2} \times 10^6 \times 74 \times 10^8) = \frac{1}{23 \times 10^{14}} \text{ of } 1l. \quad (7)$$

Supposing the actual price to be at the rate of $e \times 10l.$ for the horse-power year, we have

$$E = \frac{e}{23 \times 10^{14}} \text{ of } 1l. \quad . \quad . \quad . \quad (8)$$

Lastly, for the specific resistance of copper we have

$$s = 1640 \quad . \quad . \quad . \quad . \quad (9)$$

Using (8) and (9) in (5) we find,

$$A = c\sqrt{\frac{63 \times 10^7 \times 1640 \times pe}{23 \times 10^{15} \times \cdot 00062}} = c\sqrt{\frac{pe}{1\cdot 38}} \quad . \quad (10)$$

Suppose, for example, $p = \cdot 5$ (that is, electric work through the conductor for twelve hours of every day of the year to be provided for), and $e = 1$. These suppositions correspond fairly well to ordinary electric transmission of energy in towns for light, according to present arrangements. We have—

$$A = c\sqrt{\frac{1}{27\cdot 6}} = \frac{c}{5\cdot 25} \doteq \cdot 19.c.$$

That is to say, the sectional area of the wire in centimetres ought to be about a fiftieth of the strength of the current in webers. Thus, for a powerful arc-light current of 21 webers, the sectional area of the leading wire should be ·4 of a square centimetre, and therefore its diameter (if it is a solid round wire) should be ·71 of a centimetre. If we take $e = \frac{1}{27\cdot 6}$, which corresponds to 1900*l.* a year as the cost of 5250 horse-power (see Presidential Address, Section A), and if we take $p = 1$, that is, reckon for continued night and day electric work through the conductor, we have—

$$A = \frac{c}{\sqrt{381}} \doteq \frac{c}{19\cdot 5}:$$

and if $c = 24$, $A = 1\cdot 24$, which makes the diameter 1·26 centimetres, or half an inch (as stated in the Presidential Address). But even at Niagara it is not probable that the cost of an erg can be as small as $\frac{1}{280}$ of what we have taken as the par value for England; and probably therefore a larger diameter for the wire than $\frac{1}{2}$ inch will be better economy if so large a current as 240 webers is to be conducted by it.

Illuminating Powers of Incandescent Vacuum Lamps with Measured Potentials and Measured Currents, by Sir William Thomson and James T. Bottomley.—The electromotive force used in these experiments was derived from Faure secondary batteries, kindly supplied for the purpose by the Société la Force et la Lumière in their London office. Two galvanometers were used simultaneously, one (called the *potential galvanometer*) for measuring the difference of potentials between the two terminals of the lamp, the other (called the current galvanometer) for measuring the whole strength of the current through the lamp. The potential galvanometer had for its coil several thousand metres of No. 50 (B.W.G.) silk-covered wire (of which the copper weighs about one-twentieth gramme per metre, and therefore has resistance of about 3 ohms per metre). Its electrodes were applied direct on the platinum terminals of the lamp. The current galvanometer had for its coil a single circle, of about 10 centimetres diameter, of thick wire placed in the direct circuit of the lamp, by means of electrodes kept close together to a sufficient distance from the galvanometer to insure no sensible action on the needle except from the circle itself. The directive force on the needle which was produced by a large semicircular horseshoe magnet of small sectional area was about $2\frac{1}{2}$ c.g.s., or fifteen times the earth's horizontal magnetic force in London. This arrangement would have been better for the potential galvanometer also than the plan actually used for it, which need not be described here. The scale of each galvanometer was graduated according to the natural tangent of the angle of deflection, so that the strength of the current was simply proportional to the number read on the scale in each case. Three lamps were used, Nos. II. and III. of a larger size than No. I. The experiment was continued with higher and higher potentials on each lamp till its carbon broke. The illuminating power was measured in the simplest and easiest way (which is also the most accurate and trustworthy), by letting the standard light and the lamp to be measured shed their lights nearly in the same direction on a white ground (a piece of white paper was used); and comparing the shadows of a suitable object (a pencil was used); and varying the distance of the standard light from the white ground till the illuminations of the two shadows were judged equal. The standard used was a regulation "standard candle," burning 120 grains of wax in the hour. The burning was not actually tested by weighing, but it was no doubt very nearly right; nearly enough for our purpose, which was an approximate determination of the illuminating powers of each lamp through a wide range of electric power applied to it. The following results were obtained:—

LAMP NO. I.

No. of experiment.	Cells.	Volts.	Webers.	Volts × webers ÷ 10 ≑ kilogram-metres.	Horse-power.	Candles	Candles per horse-power.
1	26	56·9	1·21	6·88	·093	11·6	125
2	30	65·5	1·46	9·56	·129	25	194
3	32	70·2	1·64	11·51	·156	42	263
4	33	71·8	1·74	12·48	·170	38	224
5	34	74·1	1·81	13·42	·181	44	243
6	35	76·1	1·82	13·86	·187	55	294
7	36	78·0	1·99	15·52	·210	63	300
8	37	80·3	2·06	16·54	·224	66	295
9	38	81·9	2·06	16·88	·228	76	333
10	39	84·6	2·06	17·43	·235	82	349
11	40	87·0	2·10	18·27	·247	84	340
12	42	90·9	2·17	19·72	·267	102	382
13	44	92·0	2·17	19·96	·270	89	330
14	46	99·1	2·21	21·91	·296	114	385
		Carbon of lamp broke with same power, immediately after the measurement of the light was completed.					

LAMP NO. II.

No. of experiment.	Cells.	Volts.	Webers.	Volts × webers ÷ 10 ≑ kilogram-metres.	Horse-power.	Candles	Candles per horse-power.
1	40	89·7	2·207	19·8	·27	49	181
2	42	93·3	2·296	22·42	·29	68	234
3	43	95·4	2·38	22·71	·31	76	245
4	44	98·8	2·49	24·60	·33	101	306
5	46	103·0	2·63	27·09	·37	117	316
6	50	106·9	2·74	29·29	·40	147	367
7	52	110·8	2·85	31·56	·43	189	440
8	54	117·0	2·95	34·53	·47	196	417
9	56	119·8	2·95	35·34	·47	186	388
10	58	121·8	2·98	36·29	·49	177	361
11	40	87·0	2·14	18·62	·25	35	140
12	42	89·7	2·24	20·09	·27	42	156
13	60	122·8	3·06	37·58	·51	186	365
14	62	126·0	3·13	39·44	·53	180	340
15	66	132·4	3·24	42·89	·57	222	383
	70	Carbon of lamp broke.					

LAMP NO. III.

No. of experiment.	Cells.	Volts.	Webers.	Volts × webers ÷ 10 ≑ kilogram-metres.	Horse-power.	Candles	Candles per horse-power.
1	40	82·3	2·85	23·45	·31	68	219
2	50	101·8	3·90	39·70	·54	195	361
3	60	Carbon of lamp broke.					

Some of the irregularities of the results in the preceding tables are very interesting and important, as showing the effect of the

blackening of the glass by volatilisation of the carbon when too high electric power came to be applied. The durability of the lamp at any particular power must be tested by months' experience before the proper intensity for economy can be determined.

On some Uses of Faure's Accumulator in connection with Lighting by Electricity, by Sir W. Thomson.—The largest use of Faure's accumulator in electric lighting was to allow steam or other motive power and dynamos to work economically all day, or throughout the twenty-four hours where the circumstances were such as to render this economical, and storing up energy to be drawn upon when the light was required. There was also a very valuable use of the accumulator in its application as an adjunct to the dynamo, regulating the light-giving current and storing up an irregular surplus in such a manner that stoppage of the engine would not stop the light, but only reduce it slightly, and that there would always be a good residue of two or three hours' supply of full lighting power, or a supply for eight or ten hours of light for a diminished number of lamps. He showed an automatic instrument which he had designed and constructed to break and make the circuit between the Faure battery and the dynamo, so as automatically to fulfil the conditions described in the paper. This instrument also guarded the coils of the dynamo from damage, and the accumulator battery from loss, by the current flowing back, if at any moment the electro-motive force of the dynamo flagged so much as to be overpowered by the battery.

An Analysis of Relationships, by Dr. A. Macfarlane.—The paper contained a summary of the notation and elementary laws of an analytical method of dealing with such questions as, in the simplest cases, may be dealt with graphically by means of the genealogical tree. The subject is a special branch of the algebra of logic, and its development appears to the author to throw much light upon the fundamental principles of that science and to suggest important questions as to the relation of mathematical analysis to ordinary languages. The method has been applied to test the "systems of affinity and consanguinity" of Dr. Morgan of Rochester, New York.

On a Microscope with Arrangements for Illuminating the Sub-Stage, by E. Crossley.—The author stated that, using a bullseye condenser, the light from the lamp is thrown into the hollow horizontal axis of the microscope, and by means of a prism placed in the centre of this axis is reflected forwards in the direction of the axis on which the swinging sub-stage turns. The arm of a swinging sub-stage is made in the form of a box, and carries a second prism on the axis, on which it moves so as to intercept the rays of light coming from the first prism, and reflect them in the direction of the arm or box. At the end of the box is a third prism, which throws the rays of light forward on to the mirror, by means of which they are finally directed to the object on the stage. No change in the position of the microscope on its horizontal axis affects the direction of the light from the lamp, and whatever the position of the swinging sub-stage, whether above or below the stage, the illumination remains constant upon the object. The greatest facility is thus given for illuminating the object at any angle, and also seeing which is most suitable. The prisms used are one-inch, and give sufficient light for a one sixteenth-inch object-glass with a Ross B-eyepiece, a suitable condenser being used beneath the stage.

Observations of Atmospheric Electricity at Kew Observatory during 1880, by G. M. Whipple.—The author having spoken about the work already done, stated that he had devised a modification of Prof. Everett's method, and had constructed a glass scale by means of which curves could be tabulated with great facility. They had commenced tabulating and discussing the accumulated records, and he was able to state some of the facts derived from the curves for 1880. Having determined the atmospheric tension for every hour during the year when measurement of the trace was possible, the diurnal, monthly, and annual variations were computed. The months of maximum tension were January and March, and of minimum tension August and September. From the year's observations it was found that the laws vary in summer and winter; for the summer months the tension was greatest with an east wind and lowest with a north wind, whilst in winter the tension was greatest with north and north-west winds and least with south-east winds. From the results obtained it was found that light winds had a higher potential than strong winds. This, however, was not well marked in summer, but is almost entirely due to winter observations.

On Prof. Phillips' ainfall Observations made upon York Minster, by G. J. Symons, F.R.S.—The author, referring to the experiments established at York Minster, said that three gauges nearly identical in pattern were placed, one in the museum garden, one on the roof of the museum, and the third on a pole about 9 feet high placed on the centre tower of York Minster. These gauges were measured at various but identical times during the years 1832-1835, and the results were:—

	Total rain.	Ratio.
Museum garden 2 inches above ground ...	21·81 ...	100
Museum roof 44 feet ,, ...	17·39 ...	80
Minster tower 213 feet ,, ...	12·99 ...	60

Prof. Phillips stated the real amount of the diminution of rain at the upper stations depended upon the temperature of the seasons; the diminution did not vary uniformly as the square root of height, being in winter only as the cube root. Prof. Phillips' experiments soon became known, and Prof. Bache of Philadelphia set up four gauges at the angles of a square tower 162 feet high. His experiments were reported to the British Association in 1838. In 1861 Mr. Stanley Jevons made an important theoretical contribution to this investigation; he pointed out the weakness of the different extant theories, and showed that the phenomena observed were all consistent with the theory that the fall of rain was practically identical at all elevations, and that the observed differences were due to the imperfect collection by the gauges; he also stated that towers, buildings, and even the gauge itself, were obstacles to the rain-bearing current of air, and he concluded that less rain would fall on the summit of the obstacle than elsewhere, the surplus being carried forward to the lee side. Similar observations have been made during the last fifteen years, which have also been supplemented by anemometric observations, and these have proved that the difference in the amount collected was always greatest when the wind was strongest. The subject of late has been investigated by Mr. Dines, who placed several gauges 50 feet from the ground on the tower of his house. In 1877 Mr. Dines read a paper, and said that there was no actual decrease at the higher level, but a diminished collection due to eddy; he added that he found a large gauge on the tower caught much more than a small one. Mr. Rogers Field now took the matter up, and setting down the values so as to form curves he showed:—1. That the ratio of the rainfall on the tower to the rainfall on the ground depends on the force and direction of the wind. 2. That when there is no wind the rainfall on the tower is about the same as the rainfall on the ground. 3. That when there is wind the amount of rain falling on the tower will vary on different portions of the tower, the portion nearest the point at which the wind strikes the tower receiving less rain than falls on the ground, and the portion farthest from the point at which the wind strikes the tower receiving the same or more rain than falls on the ground. 4. That the excess of rain falling on the portion of the tower farthest from where the wind strikes will, to a large extent, compensate the deficiency of rain on the portion nearest to where the wind strikes, but whether to a sufficient extent to make the average amount of rain falling on the tower equal to that falling on the ground cannot be determined from these experiments. From these conclusions it is clear that if the building be flat and large, the fall in the middle of the roof ought to be nearly the same as on the ground, and in two instances this is so, first at Messrs. Marshall's factory at Leeds, and secondly Mr. Dines on a roof of 5000 square feet of area. Thus finally experimental evidence has corroborated the views of Mr. Stanley Jevons, given above.

On some of Bell and Tainter's Recent Researches and their Consequences, by W. Lant Carpenter.—The author referred to the researches of Messrs. Graham Bell and Tainter upon the sonorousness of matter under the influence of a beam of intermittent light, and described the receivers employed, in which substances are placed for examination. Porous substances gave louder sounds than dense ones, and those of a dark colour louder than light when a rapidly intermittent beam fell on them. An apparatus had been contrived by Mr. Tainter for measuring the relative sonorous powers of bodies, which was described by the author. He also stated that it had occurred to him that a modification of this apparatus might be employed for audibly estimating the relative intensities of two lights when intermittent beams fell from them upon two precisely similar receivers. The author proposed to call this instrument an audible photometer, and said that some rough experiments had somewhat justified his expectations.

On Magnetic Disturbances, by Prof. W. G. Adams, F.R.S.—The author, in considering magnetic disturbances, stated that certain facts about them had long been known; from the observations of Gauss in 1834 the disturbing power was found to increase in northern latitudes; it was also found that the appearance of a disturbance occurred in several places at the same instant, but with great differences of results. The force seemed to originate at a certain point in the interior of the earth, and the direction of the disturbing force seemed constant, yet great differences were observable at places not remote from one another. Sabine found that these disturbances had daily and yearly variations from their mean values, and that they have an eleven-year period corresponding to the appearance of spots upon the sun. It has been shown by observations that magnetic disturbances and electric currents on the earth are related; these electric currents in the earth have commonly been attributed to changes of temperature. The month of March, 1879, was chosen for a comparison of the photographic records of magnetic disturbances, and records for the whole month were sent from Lisbon, Coimbra, Stonyhurst, Vienna, St. Petersburg, and Bombay in the northern hemisphere, and from Melbourne and the Mauritius in the southern hemisphere. Taking the disturbances on March 15–16, 1879, as an instance, we see that soon after 10 a.m. Greenwich time on the 15th, a disturbance-wave happens, which shows first a diminution and then an increase of horizontal force at St. Petersburg, Vienna, Kew, and Lisbon, and also at Melbourne in Australia. At 9.30 p.m. of the same day a magnetic storm begins, and continues for about an hour. It is felt in the northern and southern hemispheres. At all stations in Europe the horizontal force is increased in the first part of the storm, and then diminished. At Lisbon the vertical force is first increased and then diminished, and at St. Petersburg and Stonyhurst there is a diminution in the vertical force at the same time as at Lisbon. Regarding the declination needles, we find that at St. Petersburg, Melbourne, and Bombay the declination westward is first increased and then diminished, whereas at Kew and Lisbon the motions are in opposite directions. At Bombay and Mauritius, near to, but on opposite sides of, the equator, the declination needles are deflected opposite ways. If we assume that by magnetic induction the earth's magnetism is altered, the position of the magnet which would cause the disturbance must be such that its pole, which attracts the marked end of our needle, must lie at the beginning of the disturbance to the east of Kew and Lisbon, to the north of Vienna, and to the north-west of St. Petersburg; the Lisbon vertical force curve also shows it to be below the surface of the earth. Hence an inductive action equivalent to a change of position of the north magnetic pole towards the geographical pole would account for these changes. The strengthening and weakening of a magnet with its north pole to the north on the meridian of Vienna might account for magnetic changes observed between 9.30 and 10.30 at night, Greenwich time, on March 15, 1879. In attempting to explain this disturbance by currents of electricity or discharges of statical electricity in the air above the needles, we must imagine that at first there is a strong current from the south-west over St. Petersburg, from the west over Vienna, and from the north-west over Kew and Lisbon, the vertical force needle at Lisbon showing that the current from the north-west lies somewhat to the east of Lisbon; that at the Mauritius this current is from the north, and at Bombay from the south. Thus we must imagine that a current of electricity passes down from the north-west to the south-east, going on towards the east over Vienna, and towards the north-east over St. Petersburg. This must be kept up very much along the same line throughout the first part of the disturbance, and then the current must be altered in strength in the same manner at all stations. An examination of the principal disturbances at Kew and at St. Petersburg seems to show that (1) a diminution in the horizontal force is accompanied by greater easterly deflections of the declination needle at St. Petersburg than at Kew; (2) increase of horizontal force is accompanied by greater westerly deflections at St. Petersburg than at Kew, or is sometimes accompanied by a westerly deflection at St. Petersburg and an easterly deflection at Kew. Only moderate disturbances have already been considered, and the author now treats of a much larger magnetic storm which began at 10.20 a.m. Greenwich time on August 11. This storm may be divided into three storms: one lasting from 10.20 on the 11th to 1 a.m. on the 12th; a second from 11.30 a.m. on the 12th to 7.20 a.m. on the 13th; and the third from 11.50 a.m. on the 13th to 7 to 8 a.m. on the 14th of August. The first storm began on August 11, at the same instant at all stations. There is a decided similarity, especially in the horizontal force curves, throughout the first part of this storm, and certain points in it stand out prominently. The deflections are alike at Lisbon, Kew, Vienna, St. Petersburg, and after the first very sudden deflection at Toronto also. The greatest effect is produced at St. Petersburg; the similarity between the large disturbances at Vienna and Toronto, in Canada, places differing about six and a half hours in time, is remarkable. About 11.45 p.m. and 2.40 p.m. there are very remarkable points of agreement. From about 4.30 p.m. to 8 p.m. Greenwich time, *i.e.* from about 11 a.m to 2.30 p.m. Toronto time, the deflections are opposed at Toronto and at Vienna or Kew. This would point rather to solar action as the cause of the disturbance. At 9 p.m. the disturbances are all in the same direction, but about 11 p.m., whilst St. Petersburg agrees in direction with the others in a very violent phase of the storm, at Toronto the direction of the deflections is reversed, and this reversal of curves continues until about the end of the first of the three storms. The second storm, the most remarkable of the three, began about 11.30 a.m. on the 12th, and lasted until the next morning. At Toronto the line goes off the edge of the paper on which the photographic record is taken. At Vienna and Melbourne the motion is so rapid that the plate is not sensitive enough to receive the impressions. At 12.20 midday, the time of greatest disturbance at Lisbon and at Zi-ka-Wei near Shanghai in China, two places nine hours different and nearly in the same latitude, the vertical force is increased in precisely the same fashion. At St. Petersburg the change in the horizontal force was one thirty-fifth part of the whole horizontal force, and the total force was changed to about one-eightieth part of its full value. These magnetic changes are so large as to be quite comparable, as we see, with the earth's total force, so that any cause which is shown to be incompetent from the nature of things to produce the one can hardly be held to account for the other.

The number of mathematicians who attended the meeting was very remarkable, and among the foreigners present may be mentioned Messrs. Halphen, Chemin, Rudolf Sturm, Cyparissos Stephanos, and W. Woolsey Johnson (Annapolis, U.S.). A separate mathematical department was formed, which met on three days, and more than thirty papers on pure mathematical subjects were read, many of them being of great interest. Prof. Halphen made a communication on Steiner's theorem relative to the positions of the centres of conics passing through three given points, and gave an elegant extension of the theorem to distinguish the cases in which the three points lay on the same or opposite branches of the curve. He also made communications on the subject of linear differential equations and hypergeometrical series; and in a fourth paper he considered the number of aspects in which points in a plane may be viewed. He showed that two points may be thus viewed in six ways, that four points can be viewed in nine ways, and illustrated this by a diagram, and extended the theorem to five points. Prof. Sturm communicated an elaborate memoir on curves of double curvature, relating to the researches of Cayley and Halphen, which was ordered to be printed *in extenso* among the reports. M. Stephanos read several papers, in one of which he showed that the different homographies which exist upon a straight line, and which are triply infinite in number, may be identified with the points of space. A simple and beautiful representation of the particulars of these systems was thus obtained.

The other papers included communications by Prof. Cayley, *On the Transformation of Elliptic Functions, and on Abel's Theorem*; by Prof. H. J. S. Smith, *On the Differential Equations satisfied by the Modular Equations, and on the Theory of the Multiplier in the Transformation of Elliptic Functions*; by Mr. J. W. L. Glaisher, *On the q-Series in Elliptic Functions*; by Dr. Hirst, *On Consequences of the Second Order and Second Class*; and by Prof. R. S. Ball, *On the Application of non-Euclidean Space to a Problem in Kinematics, and an Extension of the Theory of Screws to the Dynamics of any Material System.*

SECTION B—Chemical Science

The Present State of Chemical Nomenclature, by Prof. A. W. Williamson, Ph.D., F.R.S.—The author stated there were perhaps few departments of science in which such definite principles had been adopted, and to a great extent this applied to the